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LEVEL OF ANXIETY AND PRESENCE OR ABSENCE OF FEEDBACK IN
PROGRAMED INSTRUCTION.

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AMERICAN INST. FOR RESEARCH IN BEHAVIORAL SCIENCES

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PROCESSES, GRADE 5, PALO ALTO, CALIFORNIA, TEST ANXIETY SCALE
FOR CHILDREN (TASC)

THE EXPERIMENT DESCRIBED IN THIS REPORT INVESTIGATED THE
EFFECTS UPON CRITERION PERFORMANCE OF THE LEARNER'S
TEST-ANXIETY LEVEL AND THE PRESENCE OR ABSENCE OF FEEDBACK IN
PROGRAMED INSTRUCTION. FOUR EXPERIMENTAL HYPOTHESES WERE
TESTED DURING THE PROJECT. THE PROCEDURE EMPLOYED IDENTIFIED
EXTREME GROUPS ON A MEASURE OF TEST ANXIETY, AND THEN
ASSIGNED INDIVIDUALS AT EACH EXTREME TO FEEDBACK OR
NO-FEEDBACK VERSIONS OF A PROGRAMED INSTRUCTION LESSON ON
EARTH-SUN RELATIONSHIPS. FIFTH-GRADE SUBJECTS WERE SELECTED
FOR PARTICIPATION ON THE BASIS OF HIGH AND LOW SCORES ON THE
TEST ANXIETY SCALE FOR CHILDREN (TASC). A LEARNING PROGRAM,
AN IMMEDIATE RETENTION TEST, AND A DELAYED RETENTION TEST
WERE ADMINISTERED. FOR GIRLS, THE ANXIETY-BY-FEEDBACK
INTERACTION WAS SIGNIFICANT FOR BOTH IMMEDIATE AND DELAYED
RETENTION. FOR BOYS, NO SIGNIFICANT RELATIONSHIPS WERE FOUND.
THE IMPLICATION OF THIS FINDING TO CURRENT CLASSROOM
PRACTICES IS THAT HIGH-ANXIOUS GIRLS NEED FEEDBACK EITHER BY
PROGRAMED INSTRUCTION OR OTHER MEANS IF THE GAP BETWEEN
PERFORMANCE AND POTENTIAL IS TO BE NARROWED. THE DATA ALSO
SUGGEST THAT LOW-ANXIOUS GIRLS WOULD PROFIT FROM LEARNING
CONDITIONS WHERE MOTIVATION IS KEPT HIGH, PERHAPS THROUGH A
DELIBERATE WITHHOLDING OF FEEDBACK. (WB)

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February 1965

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LEVEL OF ANXIETY AND PRESENCE OR ABSENCE OF FEEDBACK IN PROGRAMED INSTRUCTION

Problem

The experiment described in this report was designed to investigate the effects upon criterion performance of the learner's test-anxiety level and the presence or absence of feedback in programed instruction. The focus upon anxiety as a variable grew out of a broadly conceived notion that non-intellectual differences among learners can be capitalized upon to deal with the larger problem of improving the adaptability of programed instruction. Certainly, common experience as well as research tells us that personality differences influence academic achievement.

More specifically, it was expected that test anxiety (the tendency to become anxious in evaluation situations) would be more highly related to learning by programed instruction than would general anxiety (a predisposition of the individual to be anxious in a wide variety of situations). This expectation was based on the assumption that students may perceive programed instruction to be test-like. For example, it is conceivable that the requirement in programs for frequent, written responding creates in the learner the feeling that he is being evaluated, partly by generalization from testing situations. In addition, due to the self-instructional capability attributed to programed instruction, students generally work through a program unassisted by the teacher or classmates, a second characteristic typical of a test situation.

Directly related to the assumption that the learner may attribute test-like characteristics to programed instruction was the selection of feedback-vs.-no feedback as the particular variable in program style most likely to interact with an individual's test-anxiety level. The rationale was this: Checking responses to program items (through feedback) can have the effect of reassuring the learner that his performance is adequate. On the other hand, if feedback were omitted altogether, test-like aspects of a program would be accentuated.

In short, the present study derived from the expectation that there would be an interaction between level of test anxiety and feedback in autoinstructional programs. The next two sections, Psychological Dimensions of the Problem and Literature Review, present in detail the background considerations which provided the theoretical framework for the study, and from which experimental hypotheses were derived.

Psychological Dimensions of the Problem

The background considerations which led to the present study have to do first of all with anxiety level as a psychological dimension of the learner, and secondly with feedback as a psychological dimension of program style.

Anxiety as a Psychological Dimension of the Learner

As an emotional (arousal) state, the term "anxiety" has been used interchangeably with fear (Jensen, 1958; Martin, 1961) and with tension, threat, and pressure (Reed, 1960). As an emotional response, anxiety has the property of being highly learnable (Martin, 1961; Reed, 1960). That is, the anxiety response can become conditioned to previously neutral stimuli which have been associated with pain. For example, McKeachie (1951) proposes that the "grade-oriented" anxiety of college students is due to the function of grades as "a major gateway in (the student's) path toward his major vocational and social goals." Thus, a poor student may learn to fear course examinations based on his previous experiences of the goal-blocking consequences of failing courses.

Energizing properties also have been attributed to anxiety, such that anxiety adds to the total drive present in the individual, resulting in an increased reaction potential for various competing response tendencies. Whether or not a response actually is made would depend upon whether the strongest of the response tendencies was pushed above threshold. Descriptions of this sort are most typical of the Iowa University group of investigators (Farber, 1955; Spence, 1958; Taylor, 1956).

A different emphasis is made in the Sarason-Mandler studies (Mandler and Sarason, 1952; I. Sarason, 1957a, 1958; 1961a; S. Sarason and Mandler, 1952; S. Sarason, Mandler, and Craighill, 1952). Here, anxiety is described with an emphasis on its stimulus properties, such that anxiety elicits responses which may not have been elicited if the individual were not anxious. These anxiety responses could be relevant to the task, or irrelevant. In the sense that anxiety is still viewed as an energizer, the "drive" theory of the Iowa group is recognized as being valid, but is de-emphasized.

The hypotheses tested in the present study were based on a theoretical model of anxiety derived from the extensive work done by both of the above groups. Although the Iowa studies emphasize the drive characteristics of anxiety while the Sarason-Mandler studies emphasize the stimulus properties of anxiety, it is felt that this theoretical distinction does not do violence to the model of anxiety accepted for the present study. Reviewing the theories of both groups, Nicholson (1958) concluded that "both groups recognize the validity of explanations in either sense, but tend to emphasize one position while allowing the other possibility as a subsidiary explanation."

The model of anxiety. The expectation in the present study of an interaction between anxiety level and feedback in programed instruction recognized that there is an interaction between learner variables and task variables. This interaction is described in terms of the theoretical model of anxiety adopted for this study.

Two assumptions are basic to the model:

1. It is assumed that whether or not anxiety feelings will be aroused depends on the threat characteristics of the task situation.
2. It is assumed that whether anxiety will enhance or interfere with learning depends on the individual's level of anxiety.

A derivation from the above assumptions is that, under threatening conditions, task-irrelevant (interfering) responses are elicited to a much greater degree in individuals with a high level of anxiety, as compared to other individuals.

With these assumptions in mind, the model of anxiety may now be described. Anxiety will be considered to be a learned drive with the characteristics of a strong stimulus. When anxiety has been learned as a response to situations involving intellectual achievement, anxiety feelings produced by comparable situations will in turn elicit two types of responses: responses which are relevant to the task, and responses which are not relevant to the task. Logically, task-relevant responses to anxiety lead to task completion, while task-irrelevant responses to anxiety interfere with task completion. In terms of the anxiety model, task-relevant drives are produced by anxiety (as a stimulus) and by the task (also a stimulus), and facilitation of performance is a result of the summation of these task-relevant drives. Conversely, responses to anxiety which are not relevant to the task are incompatible with task-relevant responses, and they therefore interfere with performance.

Implications of the anxiety model for the present study. One assumption of the model was that whether anxiety feelings are aroused depends on the threat characteristics of the task situation. In the present study, withholding feedback in a programed instruction task was expected to arouse anxiety feelings in individuals who were prone to perceive such a No-Feedback condition as threatening. The likelihood that withholding feedback would constitute threat was strengthened by these characteristics of the No-Feedback condition: (1) the programed instruction task was to be completed in class without help from the teacher or classmates; (2) the programed instruction would require written answers to provide an indication of task-relevant behavior; (3) no feedback would be provided to permit the learner to check his answers. Students were expected to perceive such forced responding without feedback to be test-like, in that they would not receive reassurance of adequate performance throughout the duration of the task. On the other hand, the Feedback condition was expected to be a potentially low-threat condition, in that test-like characteristics of the program would be reduced by making answers readily available to students. (The use of the term, low-threat, allows for the fact that chronically high-anxious individuals might still interpret the programed instruction as personally evaluative, and therefore even the provision of feedback could not be expected to produce a truly non-threatening condition.)

The other assumption stipulated that whether anxiety facilitates or interferes with learning depends on the individual's level of anxiety. According to the anxiety model, provision of feedback to the high-anxious learner would have two effects: (1) it would minimize task-irrelevant responses to anxiety by reducing that anxiety, and (2) the task-relevant

responses the learner did make would be reinforced as he proceeded through the program, thereby increasing the response strength of these task-relevant responses as compared to task-irrelevant responses to anxiety. It was therefore expected that under the Feedback condition, the performance of high-anxious learners would be better than their performance under the No-Feedback condition. For low-anxious learners, very little (if any) facilitating effect was expected from providing feedback, since these individuals by definition have very few task-irrelevant anxiety responses to be eliminated and since, because of the low-drive characteristic of these students, they were expected to be less susceptible to the reinforcing effect of feedback on task-relevant responses.

Feedback as a Psychological Dimension of Program Style

An investigation of how feedback might be used in programmed instruction to enhance learning requires some consideration of the functions and descriptive dimensions of feedback. The general role of feedback in programmed instruction is to provide the learner with knowledge of whether his response to a program item was right or wrong (Deterline, 1962).

Feedback in programmed instruction may be provided in a variety of ways. A light on a teaching machine may flash to indicate a correct response; the feedback term simply may appear on the following page of a programmed text, and so on. Feedback may consist of no more than the response term with which the student checks his own answer, or it may include an explanation of why the response is correct, thereby insuring that the learner understands why his answer was right or wrong.

Feedback also may be accompanied by directing or guiding comments which instruct the learner to proceed to a later frame in the sequence, if he gave the right answer, or to review previous frames or a special remedial "branch," if he gave the wrong answer. Of course, even when only the feedback term is presented, the learner can see from comparing his answer with the feedback whether or not he needs to review previous frames before proceeding through the program.

In addition to giving information, a motivational function often is attributed to feedback, though there is some controversy on this point. Skinner (1960) considers feedback in programmed instruction to be a major source of reinforcement, not only in shaping behavior, but also in maintaining it in strength. No attempt is made here to separate feedback-as-information from feedback-as-reinforcement, although some writers (Gagné, 1958; Carr, 1959) do make this distinction. The position taken here is that supplying the learner with knowledge of whether he is right or wrong is motivating only if the learner has an intrinsic interest in the task. Moreover, Porter (reference in Carr, 1959) suggests that feedback may lose its motivational value over a period of time as the novelty of the particular learning task wears off.

In a discussion by Annet (1964), the point is made that knowledge of results has both motivational and informational effects, but that these effects are difficult to isolate experimentally. That is, even when feedback is designed to be rewarding or punishing (e.g., good-bad, right-wrong),

some information is conveyed by distinguishing between desirable and undesirable responses.

The position taken in the present study is that reinforcement is a potential component of feedback, whereby the motivational effect will depend on individual differences among learners. That is, a student who has found learning to be an unsuccessful and frustrating experience may be positively motivated by observing (through feedback) that he actually is able to give right answers as he proceeds through the program. On the other hand, a highly confident, highly able and successful student might tend to be bored or insulted by consistent provision of feedback, and might thus be negatively motivated. The possibility of different consequences on performance level is obvious. Goldbeck and Briggs (1962) have taken a position similar to this.

Literature Review

The foregoing discussion concerning anxiety level and feedback in programmed instruction as Psychological Dimensions of the Problem pointed up certain implications for the study reported here. The Literature Review on the following pages was also an important source from which experimental hypotheses were derived and upon which methodological decisions were based. Since reported research did not relate anxiety to feedback in programmed instruction, the review of these two topics is made separately here.

Feedback in Programed Instruction

The effectiveness of feedback (as reinforcement) in laboratory experiments has been well established. Unfortunately, however, these findings are extremely difficult to apply to the kind of human learning which occurs in the classroom. Specifically, much of this research employed non-meaningful materials involving reflex conditioning, learning of perceptual-motor skills, or memorization of nonsense syllables, and a large number of studies were concerned with animal learning. The reinforcers (feedback devices) employed most frequently were food, water, and electric shock. Since it would be questionable to generalize from these results to human learning of complex conceptual material--in an educational setting where use of the kinds of reinforcement employed in the experimental laboratory is prohibited--no studies of this type will be reviewed here.

More in line with the present study is the growing body of programmed instruction research concerned with effects of feedback on verbal learning. Much of this research has been concerned with the form of feedback, e.g., the relative effectiveness of providing feedback as a solitary response term, or accompanied by an explanation, or imbedded in textual material, or accompanied by directing or guiding comments, etc. Since the present study is not concerned with comparisons between forms of feedback, these studies are not reviewed here. More relevant to the present study is programmed instruction research in which effects on learning have been compared when feedback is withheld entirely, or is presented continuously, intermittently, following a few seconds delay, etc. In a comprehensive review by Schramm (1962) of

published and unpublished reports of programmed instruction research, it was noted that the majority of studies investigating "schedules of feedback" support the idea that immediate knowledge of results contributes to learning. However, a few studies did not support this generally accepted finding in favor of immediate knowledge of results. Three such studies are cited here because they were believed to hold special implications for the present study.

In a study by Glaser and Taber (1961), no significant difference was found between learning when feedback was provided 50-25% of the time, as compared to "100% continuous knowledge of results." Discussing the absence of a feedback effect in their study, the authors suggested that knowledge of results probably is more important when chances of making a wrong response are high. For easy programs, or for linear programs which are designed to minimize the probability of error, it would be less important to have "continuous" feedback. The suggestion here for the present study is that the difficulty level of the experimental program could be expected to help determine the extent to which feedback becomes superfluous.

In two studies by Moore and Smith (1962a, 1962b), using programmed units in spelling and psychology, no significant differences in performance were found between groups receiving feedback and groups not receiving feedback in the programmed learning tasks. The authors cited some factors which may have reduced the measurable effects of feedback: (1) the spelling material was so easy that almost all students achieved high scores, whether or not feedback was provided; (2) the spelling program provided practice on previously presented words throughout the program so that students who technically received no feedback did in fact receive "delayed feedback" when they came to practice frames (that is, the student could tell whether he had answered correctly or incorrectly on an earlier frame by comparing the reviewed word with his recollection of his earlier answer); (3) in the psychology program, it was possible for "no-feedback" subjects to flip back to previous frames for help.

The Moore and Smith study illustrates the distinction drawn by Annet (1964) between "intrinsic" and "extrinsic" knowledge of results. Where programmed instruction is characterized by highly redundant frames and/or where responses to program items are heavily cued or prompted, the learner is able to organize the information thus provided into a sort of self-styled, or intrinsic, feedback. This intrinsic knowledge of results, as Annet points out, can be as important a source of instructional guidance as the extrinsic knowledge of results supplied by the formal feedback term.

In the present study, it was recognized that there are more sources of feedback than the formal feedback term supplied by the programmer to permit the learner to check his own answer to a program item. Only in programs where sources of intrinsic feedback are minimized can the effects of formal feedback on learning be effectively manipulated. Moreover, it was indicated earlier in this report that, in the context of the anxiety model, feedback is viewed as an "anxiety-reducer" for high-anxious individuals, over and above its information-giving function. Considered in this vein, findings like those of Glaser and Taber or Moore and Smith become even more critical, for they imply that in the present experiment the extent to which it was possible to effectively manipulate feedback (as a threat-reducer and performance-enhancer for high-anxious individuals) depended in some degree on the difficulty of the program (as determined by such factors as redundancy, cueing, and prompting).

Anxiety

An enormous amount of anxiety research has been reported. No attempt was made to cover the entire literature, but rather to focus upon those aspects which seemed most relevant to the present study, as follows: anxiety and self-report scales; anxiety and threat; anxiety and nature of the task; anxiety and ability.

Anxiety and self-report scales. Five of the best-known anxiety scales are the Test Anxiety Scale for Children (TASC) and the General Anxiety Scale for Children (GASC) developed by S. Sarason and others (1960), the Test Anxiety Questionnaire (TAQ) developed by Mandler and Sarason (1952), the Test Anxiety Scale (TAS) developed by I. Sarason (1958), and the Manifest Anxiety Scale (MAS) developed by Taylor (1951). These paper-and-pencil questionnaires take the form of self-report scales or inventories and are designed to differentiate individuals in terms of the degree to which they admit to possessing overt or manifest symptoms of general anxiety (a general characteristic or predisposition to be anxious in a wide variety of situations) and/or situational anxiety (specific to a particular threatening situation, such as a classroom test). These scales have been used widely in research investigating the facilitating or debilitating effects of anxiety on learning and usually have been found to be valid (Farber and Spence, 1953; Mandler and Sarason, 1952; Reed, 1960; S. Sarason and Mandler, 1952; S. Sarason, Mandler, and Craighill, 1952; S. Sarason and others, 1960; Siegman, 1956; Spence, 1958; Taylor, 1956; Taylor and Spence, 1952).

The present literature review is limited to a consideration of such pencil-and-paper techniques, as opposed to physiological measures of anxiety or face-to-face interviews to assess anxiety, because anxiety scales of the type noted above are by far the most frequently used measures in anxiety research conducted outside the laboratory. In these studies, subjects typically respond to an anxiety questionnaire; the obtained distribution of anxiety scores plots individuals on a (presumed) anxiety continuum, a high score indicating a high level of anxiety and a low score indicating a low level of anxiety. The performance levels of high-anxious and low-anxious persons are then compared for various kinds of learning tasks to determine whether anxiety has a facilitating or disrupting effect on performance under specified conditions.

An appropriate question raised by I. Sarason (1957a, 1958, 1959, 1961a, 1963) as well as by S. Sarason and others (1960) is whether or not better predictions of performance level may be made from scores on situational anxiety scales as opposed to general anxiety scales. In all of I. Sarason's studies, test-anxiety scores correlated significantly with test-performance scores, but general-anxiety scores did not. (The comparison being made is between the TAS or TAQ versus the MAS.) In addition, in the 1958 study, a significant interaction between anxiety and threatening instructions was obtained using the TAS, but not the MAS. S. Sarason and others (1960) reported a consistent tendency for correlations of mean achievement test score and IQ with the TASC to be negative and larger than correlations with the GASC. Although the nature of the relationship which exists between general anxiety and test anxiety is far from clear from the literature, it seems reasonable to expect that the more specific the anxiety scale is to

the experimental situation, the more will the measure of anxiety be related to performance.

Anxiety and threat. In these studies, the most common experimental design consists of comparing a high-threat condition with a low-threat, or neutral, condition. Typically, threat is injected into the experimental situation by employing personally threatening instructions as to the consequences of failure for the learner, or disparaging comments as to the quality of the learner's performance. The most frequently found result is that high-anxious learners are affected more detrimentally under the threat condition than are low-anxious learners. (Anxiety is measured in all cases by the TAS, TAQ, or MAS.)

For instance, Nicholson (1958) conducted an experiment in which subjects received threatening instructions prior to performing a learning task. He found that performance was disrupted only in the case of high-anxious subjects; for the low-anxious group, performance actually improved. Similarly, in a study to investigate the role of anxiety in a test situation, Mandler and S. Sarason (1952) found that low-anxious subjects performed significantly better than high-anxious subjects under a threat condition in which subjects were told they were doing much worse than would be expected from their aptitude scores. The results of these studies emphasize the importance of determining whether or not threat is present in the situation in which individuals are required to perform, and of considering the possible differential effects of threat on individuals at the extremes of the anxiety distribution.

Related to studies investigating the differential effects of threat on the performance of high-anxious and low-anxious individuals are studies which investigate the effects of neutral or reassuring conditions on the performance of these two groups (Mandler and Sarason, 1952; I. Sarason, 1957b, 1958; I. Sarason and Palola, 1960). In these studies, concerned with performance on a series of tasks, a reversal in the direction of the difference in performance levels between high-anxious and low-anxious groups was noted upon completion of the last task in the series. In the Mandler and Sarason study, the high-anxious group improved their performance under a neutral condition over the duration of the experiment, so that they finally surpassed the low-anxious group on the last task in the series ($P < .08$). A relevant point regarding the experimental design in the Mandler and Sarason study is that under the neutral condition, subjects were able to see whether or not they were improving from trial to trial (a type of "feedback"). In harmony with these findings, I. Sarason compared the performance of high-anxious and low-anxious groups under reassurance instructions and neutral instructions. The reassurance condition had a definite detrimental effect on the performance of low-anxious subjects and a facilitating effect on the performance of high-anxious subjects for all five trials on two tasks of different difficulty levels. The author suggested that the reassurance instructions (in the nature of "feedback") may have functioned to reduce the involvement in the task of low-anxious subject so that they "coasted."

Since in both studies high-anxious and low-anxious groups could profit from any practice effect which might have been operating, the interpretation should be offered on different grounds. It is suggested that even if the neutral or reassurance conditions were threatening to high-anxious groups (who might tend to be threatened by any condition, if they felt they were being

evaluated), their performance could still improve because task-relevant responses they did make would be rewarded over the task series and thus could come to have an increasingly competitive advantage over task-irrelevant responses to anxiety. This interpretation is consistent with the anxiety model discussed earlier. In the present study, if feedback in programmed instruction functions in a way similar to such a reassurance condition, it would be expected that the performance of high-anxious students could improve under a feedback condition whereby task-relevant responses are reinforced and become progressively stronger and more dominant than task-irrelevant responses.

Anxiety and nature of the task. Before continuing, it should be noted that there is a formidable body of opposing evidence from other studies examining the relationship between anxiety and threat--studies which demonstrate that anxiety has an overall facilitating effect on performance, and that high-anxious subjects are more facilitated than low-anxious subjects under a threat condition. Many of these studies measure learning in terms of performance on a simple, reflexive task (eye-blink) and use noxious stimuli (air puff) to arouse anxiety (Taylor, 1951; Spence and Taylor, 1951; Spence and Farber, 1953; Hilgard, Jones, and Kaplan, 1951). In other studies, performance on a rote-learning task is the criterion, and electrical shock is used to arouse anxiety (Chiles, 1958; Deese, Lazarus, and Keenan, 1953). While these studies show certain contradictions in detail, they are consistent in showing that noxious stimuli used as threat can facilitate performance on rote-learning and reflex-conditioning tasks, even for high-anxious learners. In none of the above studies, moreover, was the noxious threat shown to disrupt the performance of high-anxious subjects. Thus, these anxiety/threat studies stand in marked contrast to the body of research cited just previously. It is felt, however, that the nature of the criterion tasks (rote learning, reflex conditioning) is markedly unlike the more complex learning tasks encountered in the classroom. Further, a teacher (as wielder of threats) is barred from goading students with a live wire, as effective as he might believe that to be. Therefore, it is felt that this body of research, although contradictory to research previously cited, is not clearly relevant to the classroom study reported herein, due to the nature of the criterion tasks.

In support of this decision, it has been shown that the tendency for high-anxious subjects to perform more poorly in comparison with low-anxious subjects increases with the difficulty of the task (Farber and Spence, 1953; I. Sarason, 1958; Spence, 1958; Child, 1954; Taylor and Spence, 1952; Lazarus, Deese, and Osler, 1952; Palermo, Castaneda, and McCandless, 1956; Pickrel, 1958). Such a well-supported finding might imply that simpler learning tasks are less susceptible to the depressing effects of anxiety than are difficult tasks. In the studies just cited, task difficulty was varied by manipulating meaningfulness of material, increasing or decreasing the number of available response choices, regulating the degree of relative plausibility of alternative responses, and devising paired-associate lists so that words within a list were either more like or less like each other. A general criticism of this notion of task difficulty has been pointed out by Saltz and Hoehn (in Lawrence, 1958). That is, such studies tend to confound "difficulty" with response competition, which after all is just one component of a total learning task. More generally, it could be conceded that there could exist many reasons why a task is difficult for a given individual. Relating this observation to the anxiety model described earlier, the suggestion for the present

study was that whether or not anxiety is aroused and/or whether aroused anxiety will enhance or depress performance is partially a function of the nature of the task and of the strength of individual responsiveness to such characteristics.

Anxiety and ability. Reports of many investigators indicate negative correlations between measures of anxiety (TASC, TAQ, TAS, MAS) and scores on various intelligence tests and college aptitude batteries (S. Sarason and others, 1960; McCandless and Castaneda, 1956; Feldhusen and Klausmeir, 1962; S. Sarason and Mandler, 1952; I. Sarason, 1961a; Siegman, 1956; Phillips, King, and McGuire, 1959; Hafner and Kaplan, 1959). If the poorer performance by high-anxious subjects as compared to low-anxious subjects on such ability measures can be explained by intellectual differences among these extreme anxiety groups, then high scores on anxiety measures reflect realistic concern by high-anxious scorers over their limited abilities. However, in a comprehensive review of findings related to the negative anxiety-ability relationship, S. Sarason and others (1960) have noted that even in studies where intelligence was controlled by matching subjects, there still were differences in learning rate between high-anxious and low-anxious groups. These findings imply that anxiety level, and not intelligence level, makes for the negative anxiety-ability relationship. I. Sarason (1961a) suggests that the task situation be examined for indications of characteristics which might arouse task-irrelevant responses in high-anxious subjects; these characteristics might then be modified to reduce anxiety-derived interference and thereby enhance the performance of high-anxious individuals. His suggestion is compatible with the position taken by S. Sarason and others (1960) which holds that performance of high-anxious subjects on group intelligence tests is disrupted to the extent that the situations in which these tests are administered are saturated with test-like cues or attributes; in an evaluation situation in which such cues are minimal, the performance of "test-anxious" individuals would be interfered with little or not at all.

At any rate, considering the earlier discussion regarding task difficulty, it does seem reasonable that different abilities may determine how much can be demanded of a given individual before his anxiety feelings function to depress his performance. Similarly, different levels of anxiety may determine just how insecure the learning situation can become without provoking task-irrelevant responses which will successfully compete with task-relevant responses, with the same debilitating result. The suggestion for the present study is that the effects of anxiety on performance may interact with those of task difficulty--task difficulty being a function of the individual's intelligence as well as the intrinsic complexity of the task.

The Anxiety Experiment

Hypotheses

The literature review and the anxiety model were the sources from which experimental hypotheses for the present study were derived. These hypotheses, and a brief summary of the theoretical considerations pertaining to them, will now be presented:

1st Hypothesis. HIGH-ANXIOUS individuals will perform significantly better under the Feedback program treatment, as compared to their performance under No-Feedback.

Summary of theoretical considerations: The high-anxious learner should perform best if he receives feedback, as compared to no feedback, because providing feedback to the high-anxious learner would (1) constitute a low-threat condition which, (2) by reducing anxiety, would (3) minimize task-irrelevant responses to anxiety, and finally, (4) task-relevant responses he did make would be reinforced by feedback, thereby increasing the competitive advantage of task-relevant responses over task-irrelevant responses.

2nd Hypothesis. HIGH-ANXIOUS individuals will perform significantly better than LOW-ANXIOUS individuals under the Feedback program treatment.

Summary of theoretical considerations: Provision of feedback to high-anxious learners would improve their performance by increasing the frequency of task-relevant responses (assuming feedback is reinforcing), and by reducing anxiety feelings which elicit task-irrelevant responses. For low-anxious learners, however, the same feedback condition would not be expected to have much facilitating effect on performance because (1) these individuals, by definition, have very few task-irrelevant anxiety responses to be eliminated, and (2) they could be expected to be less susceptible to the reinforcing effect of feedback on task-relevant responses (because of the low-drive characteristic of these students).

3rd Hypothesis. LOW-ANXIOUS individuals will perform significantly better than HIGH-ANXIOUS individuals under the No-Feedback program treatment.

Summary of theoretical considerations: Anxiety produced by withholding feedback from high-anxious learners would heighten the arousal of task-irrelevant responses, thereby disrupting the performance of these individuals. Low-anxious learners (who, by definition, are relatively "anxiety-proof" in a test situation) would be less likely to perceive the No-Feedback condition as threatening.

4th Hypothesis. Performance of LOW-ANXIOUS individuals under the Feedback program treatment will not be significantly different from their performance under No-Feedback.

Summary of theoretical considerations: Because low-anxious learners, by definition, are less susceptible to the disrupting effects of stress, manipulation of feedback was not expected to have a substantial effect on the performance of these individuals. Accordingly, no difference was expected for comparisons between the low-anxious subgroups.

The Experimental Plan

The overall strategy in testing the hypotheses stated in the preceding section was to identify extreme groups on a measure of test anxiety, and then

to assign individuals at each extreme to Feedback and No-Feedback versions of a programed instruction lesson on earth-sun relationships. Using extreme anxiety groups was believed to be a desirable strategy for permitting a first test of the expected anxiety-by-feedback interaction, thereby determining whether further research would be warranted. In accordance with this strategy, all fifth-grade students¹ at two elementary schools were given the Test Anxiety Scale for Children (S. Sarason and others, 1960). High-anxious and low-anxious groups were identified separately for boys and for girls; it had been decided to make separate analyses of results for each sex because of substantial evidence of sex differences reported in anxiety research.

In addition to anxiety scores, scores on a pretest covering the content of the experimental lesson were also obtained for all fifth-grade students to provide measures of prior knowledge of the topic. The combination of High-Anxious/Low-Anxious groups and Feedback/No-Feedback programs formed a 2 x 2 design for each sex. Students not falling into the High-Anxious or Low-Anxious groups received either the Feedback or No-Feedback program to avoid giving the impression that certain students were being singled out for the experiment.

Following completion of the program, all students were administered a test as a measure of immediate retention. Nineteen days later, the same test was again administered as a measure of delayed retention. Results for both the immediate and delayed retention tests, expressed as gains over pretest scores, were analyzed by the covariance technique. The California Test of Mental Maturity IQ score was used as the predictor variable, because of the demonstrated negative relationship between anxiety level and ability in research cited earlier.

Details regarding these general procedures will be discussed in the remainder of this section. Where preparation of experimental materials and methodological decisions were guided by theoretical implications of the literature review and the anxiety model, these will be pointed out.

Subjects (Ss)

Samples of 44 girls and 36 boys were selected for experimental analysis on the basis of high and low scores on the Test Anxiety Scale for Children (TASC). The samples were obtained from the entire fifth-grade populations of two elementary schools in the San Mateo School District.

¹All fifth-graders at the two schools participated in every phase of the experiment, even though the focus of the study was confined to the achievement of high-anxious and low-anxious students. This was done to avoid suggesting to the students that the performance of certain of their classmates was being scrutinized for some special purpose; i.e., to mitigate one aspect of the experimental procedure which could be expected to produce a "reactive arrangements effect" (Campbell and Stanley, 1963).

Instructional Materials

The experimental programed instruction lesson used in this study was developed under a separate project conducted by the American Institutes for Research for the U. S. Office of Education (Contract No. OE 3-16-036). The steps by which this program was constructed and revised are outlined in a report to be prepared under that project (Campeau, in preparation). In brief, all program revisions were based on data obtained from tryouts with individual students. These data included program errors, errors on tests administered to these students, and interviews with them.

The program, entitled Day and Night and the Four Seasons: A Study of Earth-Sun Relationships, consisted of 193 frames. Funds provided under the present grant permitted only limited additional tryout and revision of the program. Data from these additional tryouts ($N = 17$) and implications from research reported herein were taken into account in obtaining the Feedback and No-Feedback versions of the program used in this study:

1. An attempt was made to revise the program until it was difficult enough to make feedback appropriate, but not so difficult that students in the No-Feedback condition were thereby seriously hampered.
2. In so far as possible, an effort was made to avoid repeating a response term in a later frame in a context identical to that in which it previously appeared as a "blank" to be filled in by the student. Not to take this precaution would have reduced the importance of providing feedback.

Except for the fact that one program version supplied feedback while the other version did not, the two program versions were identical in all respects, including the requirement for written responding by Ss.

Procedure

Administration of the Test Anxiety Scale for Children (TASC). The TASC was administered to all fifth graders at the two elementary schools. Instructions to students were taken verbatim from those provided with the TASC (in S. Sarason and others, 1960). Ss read and answered items independently. The decision to identify high-anxious and low-anxious Ss with the TASC, rather than with a measure of general anxiety, was guided by the expectation that a test-anxiety scale dealing exclusively with the learner's feelings in evaluation situations would be more highly related to performance under the experimental learning conditions than a general anxiety scale which does not deal with situations so clearly similar to the experimental learning conditions. As indicated elsewhere in this report, it was expected that learners would perceive programed instruction without feedback to be test-like; even the program providing feedback would nevertheless elicit written responses, and therefore could be perceived by a chronically high-anxious individual as personally evaluative.

Administration of the pretest. To control for prior knowledge of the subject matter covered by the experimental program, a pretest was given to all Ss nine days before the learning program was administered. The pretest

consisted of 25 items randomly selected from a pool of 116 test items covering the content of the programed lesson.

Identification of high-anxious and low-anxious Ss. A two-classification analysis of variance of TASC scores yielded no significant effects for sex, for class, or for their interaction. On the basis of this analysis, there was no justification for treating the fifth-grade classes at the two schools separately. It was decided, therefore, to pool the data for the schools. On the basis of this analysis alone, there also was no justification for treating sexes separately; however, due to conflicting evidence regarding the nature and direction of sex differences obtained in previous anxiety research, the decision was made to treat boys and girls independently in separate analyses of the experimental data. This decision was supported by the following research findings: When the TASC has been used to differentiate between high-anxious and low-anxious individuals, girls tend to score higher than boys (S. Sarason and others, 1960). In several anxiety studies conducted by the same authors (1960), boys frequently contributed more to predicted findings than girls. In other studies, higher correlations between anxiety scores and criterion scores (e.g., scores on personality scales, scores on subject-matter tests, or school grades) were found for girls than for boys (I. Sarason, 1961b, 1963; Lunneborg, 1964; Phillips, 1962). Finally, a study by McCoy (1963) found significant differences in performance under various treatment conditions for girls, but not for boys.

In the present study, cutoff points for high-anxious and low-anxious Ss corresponded approximately to the upper and lower 27% of the TASC distribution, for boys and for girls. Where more than one S obtained a TASC score at a cutoff point, Ss were selected randomly. Accordingly, 22 girls were identified as high-anxious (TASC scores from 29 to 17), and 22 girls were identified as low-anxious (TASC scores from 8 to zero). Similarly, 18 boys were identified as high-anxious (TASC scores from 26 to 16), and 18 boys were identified as low-anxious (TASC scores from 5 to zero).

Assignment of Ss to treatments. Ss were assigned to Feedback and No-Feedback treatments in terms of a 2×2 factorial design (Fig. 1).

		A N X I E T Y	
		High-Anxious	Low-Anxious
T R E A T M E N T	Feedback	N = 11	N = 11
		$\bar{x}$ TASC = 21.82	$\bar{x}$ TASC = 5.64
	No-Feedback	N = 11	N = 11
		$\bar{x}$ TASC = 22.09	$\bar{x}$ TASC = 5.09
		G I R L S	

		A N X I E T Y	
		High-Anxious	Low-Anxious
T R E A T M E N T	Feedback	N = 9	N = 9
		$\bar{x}$ TASC = 21.11	$\bar{x}$ TASC = 3.11
	No-Feedback	N = 9	N = 9
		$\bar{x}$ TASC = 20.22	$\bar{x}$ TASC = 2.78
		B O Y S	

Fig. 1. Design of the experiment. Ns and mean TASC scores for each treatment are shown.

In assigning Ss to treatments, it was necessary to keep the mean anxiety levels in the subgroups comparable; that is, the TASC mean for the high-anxious girls in the Feedback treatment should equal, or nearly equal, the TASC mean for the high-anxious girls in the No-Feedback treatment, and so on. To accomplish this, a matching procedure was followed; where several Ss received the same TASC score, they were assigned to Feedback or No-Feedback treatments randomly. As a result, the mean TASC scores for girls in both high-anxious subgroups were comparable, as were the mean TASC scores for girls in both low-anxious subgroups. The same was true for boys. Mean TASC scores for Ss in the various experimental treatments are shown in Fig. 1 on the preceding page.

Administration of the learning program. Ss progressed through the assigned version of the learning program (Feedback or No-Feedback) at their own rates. No time limit was imposed, and in addition, Ss took their normal breaks for recess, lunch, and physical education, just as when working on regular school assignments. (The mean time to complete the program was approximately 2 hours, 45 minutes.)

Administration of the immediate retention test. Each S was given a test as soon as he completed his learning program. The test consisted of 45 items drawn randomly from the same population of 116 test items from which the pretest had been selected. All Ss had time to complete the test.

Administration of the delayed retention test. In order to obtain a measure of how well Ss remembered what they had learned from the programmed lesson, the same test was re-administered to Ss after an interval of nineteen days. Again, Ss were allowed enough time to complete the test.

Experimental conditions. In the administration of all experimental measures (anxiety scale, pretest, learning program, immediate and delayed retention tests), an attempt was made to assure that instructions and procedures were fully equivalent at the two schools: (1) for every experimental session, students were assembled in a room large enough to accommodate the school's entire fifth-grade enrollment with adequate working space; (2) all experimental sessions were well monitored (approximately one monitor for every twelve Ss); (3) the same monitors assisted the Experimenter in all phases of the experiment; (4) teachers were never present during experimental sessions; (5) the writer served as Experimenter in all experimental sessions, and (6) the same instructions were supplied to all Ss either in written form or through announcements by the Experimenter who spoke from a written script.

Results

Immediate retention. A gain score (immediate retention test score minus pretest score) was calculated for each S. These gain scores were adjusted by covariance to control for differences in IQ as measured by the California Test of Mental Maturity (CTMM). Adjusted mean gain scores for Ss in the different experimental treatments are given in Table 1. Scores for boys and for girls are shown separately.

Table 1

Adjusted Mean Gain Scores on Immediate Retention Test

Girls			Boys		
Program Version	Anxiety		Program Version	Anxiety	
	High-Anxiety	Low-Anxiety		High-Anxiety	Low-Anxiety
Feedback	25.85	19.42	Feedback	17.14	18.12
No-Feedback	16.47	23.53	No-Feedback	18.02	19.83

N in each cell = 11

N in each cell = 9

The results of the analyses of covariance for adjusted gain scores are shown in Table 2. For girls, the predicted anxiety-by-feedback interaction was significant ($P < .025$). No significant interaction was found for boys.

Table 2

Summary of Covariance Analyses of Adjusted Gain Scores on Immediate Retention Test

Source	df	Girls		df	Boys	
		MS	F		MS	F
Anxiety	1	.89	-	1	17.24	-
Feedback	1	76.27	-	1	13.93	-
A x F	1	485.72	5.61*	1	1.51	-
Within (Error)	39	86.51		31	654.06	-

* $P < .025$

The correlation of ability with gain scores was .58 for girls and .69 for boys, thus justifying the covariance analysis (Lindquist, 1953). For the girls' data, differences among adjusted means in the four cells were in the hypothesized directions. The significance of these differences was assessed by the critical-difference method (Lindquist, 1953) in which

$$d = t \sqrt{\frac{2ms_{\text{error}}}{n}}$$

In the above formula, the critical value of t at the 5% level for 39 degrees of freedom was 2.02. Accordingly, the critical difference was computed to be 8.02. Differences between pairs of adjusted means for the girls' data were computed. For high-anxious girls, the Feedback version of the program yielded

significantly better performance than the No-Feedback version (Mean Diff.=9.38; $P < .05$, when $d = 8.02$). No other differences were large enough to achieve statistical significance.

Delayed retention. Analyses similar to those made for the immediate retention test scores were performed on the data from the delayed retention test. A second set of gain scores (delayed retention test minus pretest) was calculated, and analyses were performed separately for data of the girls and the boys. The adjusted mean gain scores for delayed retention are presented in Table 3.

Table 3
Adjusted Mean Gain Scores on Delayed Retention Test

Girls			Boys		
Program Version	Anxiety		Program Version	Anxiety	
	High-Anxiety	Low-Anxiety		High-Anxiety	Low-Anxiety
Feedback	23.09 (N=10)	19.17 (N=9)	Feedback	21.72 (N=8)	17.27 (N=7)
No-Feedback	14.85 (N=11)	23.69 (N=9)	No-Feedback	20.32 (N=9)	20.27 (N=9)

Correlations between CTMM IQ scores and delayed retention test scores were .53 for girls and .70 for boys. Therefore, covariance analyses again were used, with ability as the control variable. Because one or two Ss were lost from some cells due to absences from the delayed retention test session, a covariance procedure was followed which adjusted for disproportionality. Table 4 summarizes the results of these analyses for girls and boys, respectively. For girls, the anxiety-by-feedback interaction was again significant ($P < .025$); and again, no significant effects were obtained for boys.

Table 4
Summary of Covariance Analyses of Adjusted Mean Gain Scores on Delayed Retention Test

Source	df	Girls		df	Boys	
		MS ¹	F		MS	F
Anxiety	1	6.06	-	1	5.06	-
Feedback	1	3.46	-	1	.64	-
A x F	1	40.70	5.86*	1	4.84	-
Within (Error)	35	6.95		29	5.20	

* $P < .025$

¹The mean squares in this table are based upon means, a difference which follows from the procedure used for handling disproportionate Ns.

For the girls' data, differences among the adjusted means for the delayed retention test were in the hypothesized directions. The significance of these differences was assessed by a generalization of the critical difference method (Lindquist, 1953) in which

$$d = t \sqrt{\frac{2ms_{\text{error}}}{\text{mean cell frequency}}}$$

In this analysis, the value of t at the 5% level for 35 degrees of freedom was 2.03, and the critical difference was computed to be 7.75. Two differences exceeded this value; i.e., were significant at the 5% level: (1) High-anxious girls under the Feedback condition surpassed the performance of high-anxious girls under the No-Feedback condition (Mean Diff.=8.24; $P < .05$, when $d=7.75$), and (2) low-anxious girls surpassed the performance of high-anxious girls under the No-Feedback condition (Mean Diff.=8.84; $P < .05$, when $d=7.75$).

Retention losses. Nineteen days intervened between the immediate and the delayed retention tests. Average amounts of retention loss (forgetting) which occurred in this period were determined by subtracting mean delayed retention test scores from mean immediate retention test scores, and converting these to per cents. Computations were based on unadjusted means.¹ The results are given in Table 5.

Table 5

Mean Amounts of Retention Loss Expressed in Per Cents

Girls			Boys		
Program Version	Anxiety		Program Version	Anxiety	
	High-Anxiety	Low-Anxiety		High-Anxiety	Low-Anxiety
Feedback	-15.9%	-9.4%	Feedback	+1.8%	-37.4%
No-Feedback	-20.4%	-2.0%	No-Feedback	-9.1%	-16.3%

Since no reliability analyses were performed for these data, the following comments rest upon inspection of the data in Table 5. For girls, retention loss appears to be more highly related to anxiety level than to program treatment, with high-anxious girls suffering a greater retention loss than low-anxious girls. For boys, retention loss also appears to be more highly related to anxiety level than to program treatment; however, the trend is reversed, with low-anxious boys suffering a greater retention loss than high-anxious boys.

¹The covariance procedure used for delayed retention analyses to adjust for disproportionality produced adjusted means which were not numerically comparable to those from the immediate retention test.

Discussion

Contrasting findings for girls and for boys. Perhaps the most striking result of this study is the contrasting findings for girls and for boys. For girls, the anxiety-by-feedback interaction was significant in terms of both immediate and delayed retention, clearly confirming the expectation of an interaction between anxiety level of the learner and presence or absence of feedback in the instructional program. For boys, no significant effects were found in either immediate or delayed retention.

Evidence of sex differences in previous anxiety research has been cited elsewhere in this report, indicating that in some studies boys have contributed more to findings of significant effects than girls, and that in other studies girls have exerted the greater influence on results obtained. Also cited was the very consistent tendency for girls to obtain higher anxiety scores than boys, indicating that there are more situations to which girls respond anxiously and/or that when they do experience anxiety, it is a stronger response than in the case of boys. If this greater predisposition for girls to be test-anxious is considered in the context of the theoretical anxiety model described earlier, one would expect predictions about the interfering effects of anxiety to be more clearly demonstrated for girls than for boys. Because data for boys and girls were analyzed separately in this study, no statements can be made regarding the main and interactive effects of the sex variable. However, the fact that girls' data supported experimental expectations, while boys' data failed to confirm these predictions is generally consistent with earlier findings.

Evaluation of the experimental hypotheses. The experimental hypotheses which were stated on p. 11 may now be evaluated, for girls, in terms of the analysis of the data.

1st Hypothesis. HIGH-ANXIOUS individuals will perform significantly better under the Feedback program treatment, as compared to their performance under No-Feedback. This hypothesis was supported by the data ($P < .05$, immediate retention analysis; $P < .05$, delayed retention analysis). The fact that the hypothesis was supported suggests that the theoretical considerations from which it was derived have some merit. To recapitulate briefly, it was reasoned that providing feedback to high-anxious learners would constitute a low-threat condition which, by reducing anxiety, would minimize task-irrelevant (interfering) responses to anxiety; furthermore, that additional facilitation of performance would be attributable to the increased strength of task-relevant responses over task-irrelevant responses (resulting from feedback reinforcement for responses to program items).

2nd Hypothesis. HIGH-ANXIOUS individuals will perform significantly better than LOW-ANXIOUS individuals under the Feedback program treatment. This hypothesis was not supported, although means were in the hypothesized direction in both immediate and delayed retention analyses.

3rd Hypothesis. LOW-ANXIOUS individuals will perform significantly better than HIGH-ANXIOUS individuals under the No-Feedback program treatment. This hypothesis was supported ($P < .05$, delayed retention analysis). In line with the theoretical position outlined earlier, it is suggested that for low-anxious individuals (who, by definition, are relatively "anxiety-proof" in a test-like

situation), performance is less likely to be disrupted under a No-Feedback condition, since these students would not be inclined to perceive this condition as threatening. For high-anxious learners, on the other hand, withholding feedback would arouse anxiety feelings (which in turn would elicit task-irrelevant responses), thereby disrupting the performance of these individuals.

4th Hypothesis. Performance of LOW-ANXIOUS individuals under the Feedback program treatment will not be significantly different from their performance under No-Feedback. This null hypothesis was accepted on the basis of the data ($P > .10$, immediate retention analysis; $P > .10$, delayed retention analysis). It will be recalled that, because low-anxious individuals are defined as being less susceptible to the disrupting effects of stress, manipulation of feedback was not expected to have a substantial effect on the performance of these individuals. The data do not contradict this expectation.

Implications of the "duplicate" finding of an anxiety-by-feedback interaction in immediate and delayed retention analyses. In the present study, a "feedback" condition was provided (to half the Ss) only during learning. Once the programed lesson had been completed and the test begun, all students were in a "no-feedback" condition, in that the test was unaccompanied by cues, prompts, or other guiding comments, and no answers were provided with which students could check their answers. According to findings from the anxiety research previously cited, high-anxious children should then have been at their greatest disadvantage, since they were in a test situation--a situation which typically threatens high-anxious individuals and disrupts their performance. It is always difficult to differentiate between learning and performance. In this regard, further speculation may be in order as to why feedback-during-learning produced superior immediate and delayed retention test performance for high-anxious individuals.

It is suggested that superior performance on the immediate retention test may have been a carryover from the experimental learning condition whereby feedback reassurance had so reduced anxiety responses in high-anxious individuals that, when confronted with the test, they were able to go on responding with task-relevant responses--a "carryover" from the Feedback learning condition immediately preceding the test. If this were the case, it might have been expected that differences would wash out on the delayed retention test--or even that high-anxious individuals would do worse than low-anxious individuals on the delayed retention test, because they would no longer be benefiting from any "reassurance carryover" from the Feedback learning condition which might have facilitated their performance on the immediate retention test. However, the High-Anxious/Feedback group was still superior in their performance on the delayed retention test. A modified explanation would be that receiving feedback during programed learning lessened task-irrelevant (interfering) responses during immediate and delayed retention test sessions by allowing high-anxious individuals to practice task-relevant responses elicited by the programed instruction lesson. In being forced to respond in writing to literally hundreds of questions throughout the program, and in being reassured of the adequacy of their responses by feedback, high-anxious learners were in a sense taking a "series of quizzes" over program content which prepared them for the immediate and delayed retention tests. For these individuals, feelings of preparedness with respect to being able to answer questions about the programed lesson

(and test questions were quite similar to questions asked in the program) could then have functioned to reduce disruptive effects of anxiety during the subsequent tests over program content.

Practical implications of the results. Turning finally to the question of practical implications of these findings for current classroom practices, there is a strong suggestion that high-anxious girls need feedback (either provided by programed instruction or in some other way), if "the gap between performance and potential" (S. Sarason and others, 1960) for these students is to be narrowed. On the other hand, the data suggest that low-anxious girls would profit from learning conditions where motivation is kept high, perhaps through the deliberate withholding of feedback. Where programed instruction carries a substantial share of the instructional load, this could be accomplished with mechanical or format adjustments, whereby feedback would not be available to these students.

Where teachers do not use programs, but conduct instruction in the conventional way, one wonders if certain adjustments in their procedures might enhance the performance of extreme anxiety groups. This study suggests that for different kinds of learning situations it is likely that anxiety, or other non-intellectual characteristics of learners, should be considered in regard to the format of instruction (programed, or otherwise). This would especially be the case when students are asked to respond in some way during learning, thereby creating an evaluative situation which would produce the same anxiety-feedback effects found in this study.

Suggestions for future research. In view of the fact that programed instruction is finding increasing applications at all grade levels and in nearly all subject matters encountered in our schools, findings from the present study suggest two worthwhile problems for future investigation. First, in addition to conducting replications of the present study in schools at various socio-economic levels, similar studies are needed in which feedback and no-feedback programs in different subject matters are administered to high-anxious and low-anxious learners at different grade levels. Taken together, data from such a comprehensive set of studies, if extending the findings to the entire anxiety range, would permit greater generalization about the interaction between anxiety and feedback in programed instruction, based on grade, subject-matter, and sex considerations.

Second, more elaborate research is needed to take into account the teacher variable. That is, when programed instruction is integrated with conventional classroom teaching, the teacher will be another source of influence on student performance (Goldbeck, and others, 1962). Consciously or not, teachers engender in their students positive or negative attitudes towards learning, tests, failure, and success. When children feel that they must do well in order to be liked by their teacher--and assuming they want to be liked by her--the sense of security of these children will depend greatly on their level of performance (S. Sarason and others, 1960). In terms of the anxiety model outlined earlier, the nature of the teacher's response to student performance (over and above considerations of the nature of feedback provided by programed instruction) will help determine the degree to which classroom atmosphere (as a learning condition) is stressful or reassuring. Thus, the teacher variable has implications for future research along the lines begun in this study, because of the expectation that differences in teacher responses to student performance will interact with programed instruction variables (e.g., feedback) and with the learner's level of anxiety.

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APPENDIX

A copy of the test over the experimental programmed instruction lesson is shown on the following pages. This same test was used to obtain measures of both immediate and delayed retention of program content.

DIRECTIONS: Please use the WORD LIST to keep your answers covered! If you don't know the answer to a question, put a wavy line like this (~~~~~) in the blank. IT IS ALL RIGHT TO GUESS.

IF YOU KNOW THE ANSWERS TO THE QUESTIONS ON THIS PAGE, FILL IN THE BLANKS:

1. The spinning of the earth is called >>> _____
2. The imaginary line running through the earth from the North Pole to the South Pole is called the >>> _____
3. "The sun does not travel around the earth. Instead, it is the earth which makes the journey around the sun."
What is a better word for "makes the journey" in the second sentence above? >>> _____
4. How many degrees does the earth's axis tilt? >>> _____
5. Days and nights are the SAME LENGTHS every place in the world on two dates. These two dates are >>> _____ (month & day)
_____ and >>> _____ (month & day)
6. People living along a certain imaginary line always have days and nights which are equal in length. What is this imaginary line called? >>> _____
7. Two times a year, days and nights are the same lengths everywhere in the world. This is called the _____
8. Name the four seasons, in order. (You may start with any of the four seasons.) >>> _____ (season)
>>> _____ (season)
>>> _____ (season)
>>> _____ (season)

GO RIGHT ON TO THE NEXT PAGE

FOR QUESTIONS ON THIS PAGE, WRITE THE LETTER OF THE ANSWER IN THE BLANK:

9. Night and day are caused by
a. the sun moving around the spinning earth.
b. the sun shining on the spinning earth.
c. the sun heating the spinning earth.
d. the sun traveling across the sky.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

10. The earth rotates from
a. north to south.
b. west to east.
c. south to north.
d. east to west.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

11. Polar lands have no day at all for part of the year.
This happens when the
a. revolution of the earth causes the sun's rays to miss these areas.
b. rotation of the earth causes the sun's rays to miss these areas.
c. movement of the earth causes the sun's rays to miss these areas.
d. tilt of the earth causes the sun's rays to miss these areas.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

12. The sun seems to move from east to west across the sky.
This is because the
a. earth revolves around the sun from west to east.
b. sun revolves around the earth from east to west.
c. earth rotates from west to east.
d. earth rotates from east to west.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

13. The earth makes a complete turn on its axis once each
a. week.
b. day.
c. month.
d. year.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

14. People who live in the hemispheres usually have days and nights which are NOT equal in length. This is because
a. the earth tilts.
b. the earth revolves around the sun.
c. the sun never shines at the poles.
d. the hemispheres have seasons at opposite times.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

15. The Northern Hemisphere has its seasons at opposite times from the Southern Hemisphere. This is because of the
a. direction of the earth's rotation.
b. tilt of the earth's axis.
c. direction of the earth's revolution.
d. different lengths of days and nights in the hemispheres.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

16. The earth makes a complete trip around the sun once each
a. day.
b. week.
c. month.
d. year.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a, b, c, d?)

FOR THE QUESTIONS ON THIS PAGE, WRITE THE LETTER OF THE ANSWER IN THE BLANK:

17. Write down the letter of the correct PAIR OF STATEMENTS about the earth's ROTATION and REVOLUTION:

- a. { Revolution takes longer than rotation.
Revolution is like turning around something;
rotation is like traveling around something.
- b. { Revolution takes less time than rotation.
Revolution is like traveling around something;
rotation is like turning around something.
- c. { Revolution takes longer than rotation.
Revolution means moving around an object;
rotation means spinning.
- d. { Revolution takes less time than rotation.
Rotation means moving around an object;
revolution means spinning.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

18. Write down the letter of the correct PAIR OF STATEMENTS:

- a. { The earth rotates from east to west.
The sun seems to move across the sky from east to west.
- b. { The earth rotates from west to east.
The sun seems to move across the sky from west to east.
- c. { The earth rotates from east to west.
The sun seems to move across the sky from west to east.
- d. { The earth rotates from west to east.
The sun seems to move across the sky from east to west.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

19. Chicago is many miles east of San Francisco, so it has sunrise before San Francisco does. This is because the

- a. earth spins from east to west.
- b. earth spins from west to east.
- c. sun moves across the sky from east to west.
- d. sun moves across the sky from west to east.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

20. The four seasons are caused by the

- a. sun shining directly at the Tropic of Cancer or the Tropic of Capricorn.
- b. earth traveling around the sun in a tilted position.
- c. sun shining directly at the equator for part of the year.
- d. earth spinning as it travels around the sun.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

21. No matter which season it is, the temperatures at the equator will always be higher than the temperatures at the poles.

This is because

- a. there is snow at the poles, but not at the equator.
- b. the equator is closer to the sun than the poles are.
- c. the sun's rays are more direct at the equator than they ever are at the poles.
- d. the sun's rays carry less heat to the poles than they do to the equator.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

FOR THE QUESTIONS ON THIS PAGE, WRITE THE LETTER OF THE ANSWER IN THE BLANK:

2. It is usually warmer in the afternoon than in the morning because

- a. the sun's rays get hotter as the day goes on.
- b. the earth stores up heat from the sun during the day.
- c. the sun's rays are more direct in the afternoon than in the morning.
- d. the earth leans toward the sun more in the afternoon than in the morning.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

3. The Northern Hemisphere is usually warmer in August than it is in June because the

- a. earth stores up heat during June and July.
- b. sun's rays are more direct in the Northern Hemisphere in August than they are in June or July.
- c. earth leans toward the sun more in August than in June or July.
- d. sun's rays get hotter in August than they were in June or July.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

4. What would be the effect on the four seasons in the NORTHERN Hemisphere, if the tilt of the earth's axis were switched to just the opposite direction?

- a. We would have just one season all year.
- b. We would still have four seasons, but they would start on the dates we learned for the Southern Hemisphere.
- c. We would still have four seasons, but they would come in a different order.
- d. We would have two seasons during the year.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

5. During summer in the NORTHERN Hemisphere, we have long days and short nights. What would be the effect on the lengths of day and night if the earth suddenly switched from a tilted position to an upright (not tilted) position?

- a. Days would still be longer than nights, but not so much as before.
- b. Days and nights would be equal lengths.
- c. Days would be a little shorter than nights.
- d. Days would last for twenty-four hours.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

6. Polar lands are called "lands of the midnight sun" because they have

- a. all daylight and no darkness for the whole year.
- b. all darkness and no daylight for the whole year.
- c. almost all daylight and very little darkness for part of the year.
- d. such bright moonlight that it is like sunlight.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

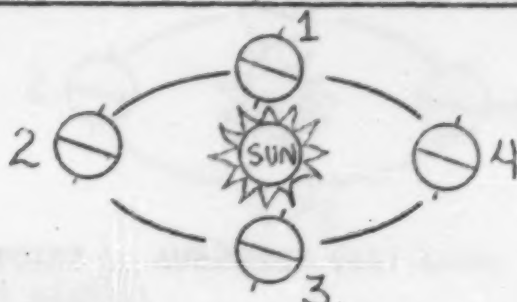
7. What would be the effect on the four seasons in the NORTHERN Hemisphere, if the direction the earth travels around the sun were switched to just the opposite direction?

- a. We would still have four seasons, but they would start on the dates we learned for the Southern Hemisphere.
- b. We would still have four seasons, but they would come in a different order.
- c. We would still have seasons, but not four of them.
- d. We would still have four seasons, but they would not start on any of the dates we learned.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>—————→

(a,b,c, or d?)

LOOK AT THE PICTURE BELOW TO ANSWER THE QUESTIONS ON THIS PAGE:



28. What is the season in the NORTHERN Hemisphere when the earth is at POINT 1 in the picture above?

a. summer
b. winter
c. spring
d. autumn

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

29. What is the season in the NORTHERN Hemisphere when the earth is at POINT 3 in the picture above?

a. summer
b. winter
c. spring
d. autumn

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

30. What season is it in MADAGASCAR, when the earth is at POINT 3 in its journey around the sun? (Use the map.)

a. summer
b. winter
c. spring
d. autumn

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

31. What season is it in GERMANY, when the earth is at POINT 1 in its journey around the sun? (Use the map.)

a. summer
b. winter
c. spring
d. autumn

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

32. At which point in the earth's journey around the sun would the SOUTHERN Hemisphere have SUMMER?

a. Point 1
b. Point 2
c. Point 3
d. Point 4

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

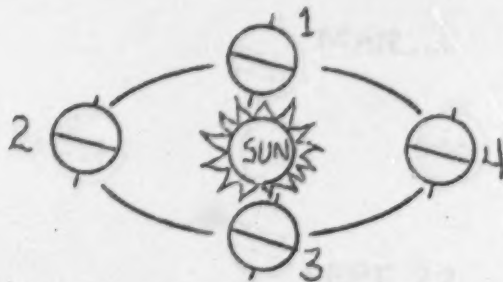
33. At which point in the earth's journey around the sun would the SOUTHERN Hemisphere have SPRING?

a. Point 1
b. Point 2
c. Point 3
d. Point 4

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a,b,c, or d?)

LOOK AT THE PICTURE BELOW TO ANSWER THE QUESTIONS IN THIS BOX:



34. When the earth is at POINT 1, AUSTRALIA will have: (Use the map.)

- a. long days and short nights.
- b. short days and long nights.
- c. equal days and nights.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, or c?)

35. When the earth is at POINT 4, the UNITED STATES will have:

- a. long days and short nights.
- b. short days and long nights.
- c. equal days and nights.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, or c?)

LOOK AT THE PICTURE BELOW TO ANSWER THE QUESTIONS IN THIS BOX:



36. As the earth travels around the sun, at which point will the NORTHERN Hemisphere be coldest?

- a. Point 1
- b. Point 2
- c. Point 3
- d. Point 4

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, c, or d?)

37. The lands inside the ARCTIC CIRCLE will have 24 hours of daylight when the earth reaches

- a. Point 1
- b. Point 2
- c. Point 3
- d. Point 4

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, c, or d?)

38. The SOUTHERN Hemisphere will have day and night of equal lengths when the earth reaches

- a. Point 1
- b. Point 2
- c. Point 3
- d. Point 4

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, c, or d?)

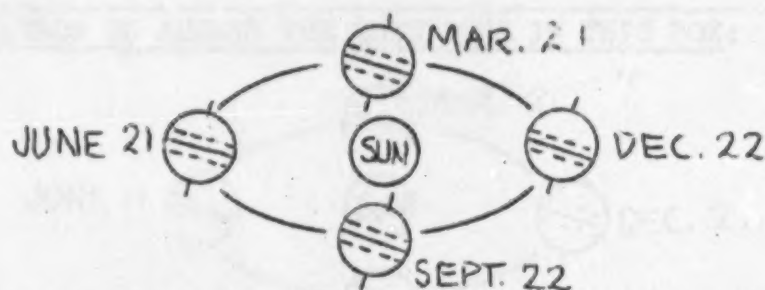
39. The NORTHERN Hemisphere will have long days and short nights when the earth reaches

- a. Point 1
- b. Point 2
- c. Point 3
- d. Point 4

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, c, or d?)

LOOK AT THE PICTURE BELOW TO ANSWER THE QUESTIONS ON THIS PAGE:



40. Charlie Brown calls your travel agency about taking a trip to AUSTRALIA. (Use your map, if you need to.) He wants to land there on the first day of AUTUMN in AUSTRALIA. You should get him a ticket which lands him there on
- June 21.
 - September 22.
 - December 22.
 - March 21.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a,b,c, or d?)

41. If Charlie Brown had wanted to land on the first day of WINTER in AUSTRALIA, you would get him a plane ticket which would land him there on
- June 21.
 - September 22.
 - December 22.
 - March 21.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a,b,c, or d?)

42. When it is autumn in the SOUTHERN Hemisphere, the sun's rays are most direct at the
- Arctic Circle.
 - Tropic of Cancer.
 - equator.
 - Tropic of Capricorn.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a,b,c, or d?)

43. When it is winter in the NORTHERN Hemisphere, the sun's rays are most direct at the
- Arctic Circle.
 - Tropic of Cancer.
 - equator.
 - Tropic of Capricorn.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a,b,c, or d?)

44. Two times during the year, every place in the world has day and night of equal lengths. This is when the sun's rays are
- most direct at the equator.
 - most direct at the Tropic of Cancer.
 - most direct at the Tropic of Capricorn.
 - direct at both the equator and the Tropics at the same time.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

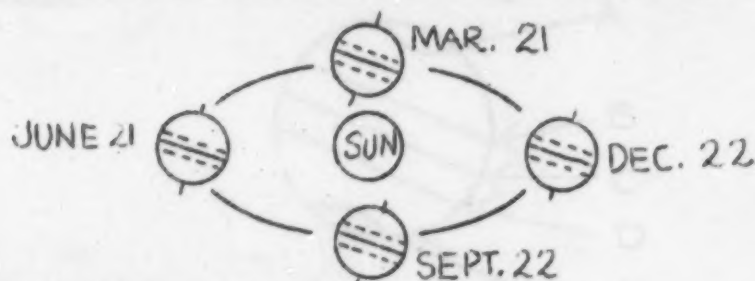
(a,b,c, or d?)

45. When the SOUTHERN Hemisphere has winter, people in that hemisphere will have
- shorter days than nights.
 - equal days and nights.
 - longer days than nights.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>> →

(a, b, or c?)

LOOK AT THE PICTURE BELOW TO ANSWER THE QUESTIONS IN THIS BOX:



46. When the SOUTHERN Hemisphere has autumn, people in the Southern Hemisphere will have

- a. shorter days than nights.
- b. equal days and nights.
- c. longer days than nights.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a, b, or c?)

47. In the SOUTHERN Hemisphere, the date of the first day of spring is

- a. June 21.
- b. September 22.
- c. December 22.
- d. March 21.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a, b, c, or d?)

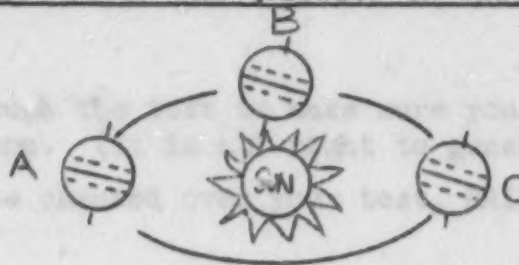
48. In the NORTHERN Hemisphere, the date of the first day of summer is

- a. June 21.
- b. September 22.
- c. December 22.
- d. March 21.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a, b, c, or d?)

LOOK AT THE PICTURE BELOW TO ANSWER THE QUESTION IN THIS BOX:



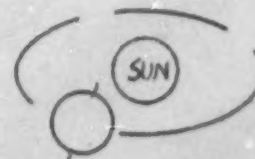
49. When the earth is at POINT A, the sun's rays will strike most directly at the

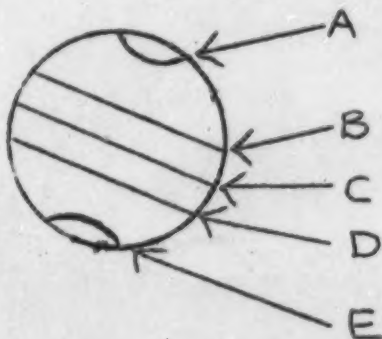
- a. Arctic Circle.
- b. Tropic of Cancer.
- c. equator.
- d. Tropic of Capricorn.

WRITE DOWN THE LETTER OF THE CORRECT ANSWER HERE >>>

(a, b, c, or d?)

50. Make arrows out of the lines in the picture to show in which direction the earth travels around the sun >>>





51. In the picture above, the TROPIC OF CANCER is marked with the letter

(A, B, C, D, or E?)

52. DRAW A CIRCLE AROUND the countries in the answer column which are ALL, OR PARTLY IN the "land of the midnight sun" for part of the year. (Use your map.)

GREENLAND
SWEDEN
AUSTRALIA
ALASKA
ANTARCTICA
RUSSIA
CANADA
NORWAY
JAPAN
INDIA
FINLAND

IMPORTANT!!! Go back through the test to make sure you did not forget to answer some questions. (It is all right to guess.)

When you have checked over your test, RAISE YOUR HAND.